Know the Earth...Show the Way
Metadata Monthly
NGA/DCGS Metadata Harmonization
Issue 17
February 2009

Towards a Common, Sensor Web Environment

Military operations require many high capacity sensors working cohesively as one integrated system across a wide geographic area. The feeds from heterogeneous sensors must be consolidated, coordinated, and interpreted.

Historically, each sensor system used a proprietary language to transmit and record its observations. When heterogeneous sensors were cobbled together into one system, translation processing was required to normalize sensor data for processing consolidation, coordination, and interpretation. These legacy sensor systems lacked the agility to dynamically meet ever-changing military operations' collection and exploitation requirements.

Times have changed. Currently, sensors' properties and measured content have reached a maturity level where a generalized metadata schema can enable discovery.

This article describes the Open Geospatial Consortium® (OGC) Sensor Web Enablement (SWE) Framework and one successful military demonstration of that SWE Framework.

SWE Standards and Specifications

The OGC® creates technical documents that detail interfaces and encodings. In the large, these technical documents are referred to as OpenGIS® standards and specifications. A subset of the OGC® OpenGIS standards and specifications forms the SWE Framework. "The … SWE standards enable developers to make all types of sensors, transducers and sensor data repositories discoverable, accessible and useable via the Web."[1] The SWE Working Group includes international academic, government, and commercial members in collaboration to create the data standards and service specifications. SWE Framework standards apply to many different types of remote sensors pictured below:

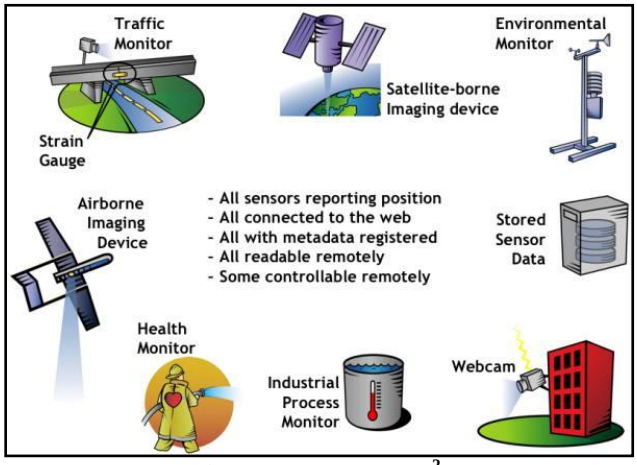

Figure 1. OGC SWE[2]

SWE Framework standards are grouped in several categories:[3]

1. **Observations & Measurements (O&M)** – General models and XML encodings for observations and measurements.
2. **Sensor Model Language (SensorML)** – Standard models and XML schema for describing the processes within sensor and observation processing systems.
3. **Transducer Markup Language (TransducerML or TML)** – Conceptual

[1] http://www.opengeospatial.org/ogc/markets-technologies/swe, accessed 03 Feb 2009.
[2] Ibid, accessed 03 Feb 2009.
[3] http://www.opengeospatial.org/projects/groups/sensorweb, accessed 30 Jan 2009.

Know the Earth...Show the Way
Metadata Monthly
NGA/DCGS Metadata Harmonization
Issue 17
February 2009

model and XML encoding used to support real-time streaming of observations and tasking commands from and to sensor systems.

4. **Sensor Observation Service (SOS)**-Open interface for a web service to obtain observations and sensor and platform descriptions from one or more sensors.
5. **Sensor Planning Service (SPS)**-An open interface for a web service by which a client can: determine the feasibility of collecting data from one or more sensors or models and: submit collection requests.
6. **Sensor Alert Service (SAS)**-A standard web service interface for publishing and subscribing to alerts from sensors.
7. **Web Notification Services (WNS)**-A standard web service interface for asynchronous delivery of messages or alerts from SAS and SPS web services and other elements of service workflows.

SWE Software Demonstration

The Open Geospatial Consortium® endorses several products as open source, free-ware, or Commercial Off-the-Shelf (COTS) components developed in concert with the SWE Framework. Products include "…[S]oftware to support servers, middleware, and clients, as well as tools for creating and validating SWE encodings."

Of particular interest, the NGA Empire Challenge 2008 (EC08) Demonstrations prototyped sensors recording natively in SWE TML format. Unmanned Aerial Systems sensors recorded video using Motion Picture Experts Group-2 and Key-Length-Value encoding formats, later translating to SWE TML. Both metadata streams were exposed using the DCGS Integration Backbone Metadata Catalog to the EC08 demonstration environment for discovery by a Distributed Common Ground System-Army (DCGS-A) search service. The successful EC08 Demonstrations highlighted the SWE standards' flexibility and adaptability in the DCGS environment.

Summary

The SWE Framework is aimed at developing a sensor network decoupled from proprietary sensor control and exploitation software, increasing the agility of the sensor infrastructure and therefore the effectiveness of multi-purpose sensors. This concept mirrors the "plug-and-play" hardware architecture of personal computing devices; hardware devices become vendor-neutral with respect to the software hosted on them.

The SWE Framework provides guidance for sensor data representation, description, and manipulation using services. The SWE Framework specifies both the data and application layers of a Service Oriented Architecture (SOA). And, software developers have created SWE "oriented" client software. Thus, SWE spans the SOA layers providing a common reference architecture implementation for the Government Geospatial Community already embraced in commercial industry.

For Comments or Questions contact:

Maj. Mike Schar NGA/ASXT (703-755-5408)
Michael.J.Schar@nga.mil
Dr. Lou York MITRE (781-271-3880)
lyork@mitre.org